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TITLE: Phase II-SOF Knowledge Coupler-Based Phase I XML Schema

PRINCIPAL INVESTIGATOR: COL Warren L. Whitlock

CONTRACTING ORGANIZATION: SE Regional Medical Command  
Fort Gordon, Georgia 30905-5650

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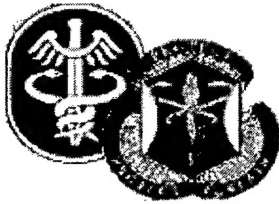
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# Mid-Term Report



PROPOSAL NO.: 2002011125

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## ACCOMPLISHMENTS

To analyze the Special Operations Forces Medical Handbook (SOFMH) content an initial text parser was built that placed text into a structured database using text source files. This database provided the original information to display to SOF medics or editors using the application.

Several robust database applications were created to allow manipulation and display of medical knowledge over the complete SRMH content. A web-enabled application is being completed to allow online updating and virtual collaboration of geographically separated authors and subject matter experts to meet the author and editorial review board requirements. This application is necessary to allow authors to build associations necessary to the formulation of the relationships integral to the relationships in the database. Author and subject matter expert input is required to maintain the suitability of the suggested treatment to the capabilities of the SOF medic over subsequent versions of the knowledge engine application.

An image database was created to manage the 700+ images included in the CD-ROM version of the SOFMH. This database includes assignments of the College of American Pathologists' Systematized Nomenclature of Medicine – Clinical Terms (SNOMED-CT) codes to particular images. These images are contained in an online catalog as well as appearing on their original SOFMH CD-ROM topic page. The SNOMED-CT codes are used to establish relationships with topic content per the author/subject matter expert's recommendations.

Other project accomplishments to date are:

- DOD SNOMED-CT Database developer license awarded from the College of American Pathologists. This license was necessary to obtain the SNOMED-CT nomenclature relationship files.
- Comprehensive Analysis of the SNOMED-CT database architecture. SNOMED-CT Database browser created to determine extensive relationships for obscure symptom analysis and query formulation for the knowledge coupler engine.

- Created a relationships database for use in the Special Operations Forces Medical Knowledge Coupler (SOFMKC). This database contains the original content, SQL scripts, and stored procedures to manage the interactivity of the application as well as the source data for the knowledge coupler display. This database is necessary to provide the linkages between the navigation hierarchy of the SNOMED-CT concepts and the signs and symptoms indicated in a patient interview. A separate web tool was written to display the relationships between distinct SNOMED-CT concepts. This tool was necessary to determine the scope of each concept ID and its relationship to other concept IDs, contrived through the linkage of other concept IDs that are used to determine the type of relationship of the two original concept IDs. Examples of these relationships might be parent, child or sibling, etc.

PI Evaluation: Project Accomplishments Match Proposal

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## PROBLEMS/ISSUES

The clinical symptoms and robust relationship codes and modifiers with in SNOMED-CT are not complete. Relationships do not exist for many of the symptoms and signs that need to be available for the medics to adequately meet the demands of emergency medicine to the extent required in a first responder in primitive environments where immediate transfer of care is not available. These relationships can be supplied through our online knowledge-coupler development and subject matter experts and clinicians who are familiar with the presentations of these symptoms and therefore are able to accurately describe or identify them in advanced or non-typical presentations. The collaboration necessary to assemble these individuals and maintain focus on this project in the face of extremely busy case loads and difficulties in travel and scheduling conflicts led to the need for an online editorial application (in development). This online application requires high security to authenticate the user, thereby maintaining the audit trail accounting of information and credible source content, and the ability to conference on particular topics. It also requires the creation of an editorial board role to both solicit input and limit updating of information. Where differing opinions create deadlock, the editor board will be able to halt further editing or prevent out-of-cycle changes to the content.

Current technologies cannot adequately store the amount of information required to be available in a hand-held device using a stand-alone application. The SNOMED-CT nomenclature alone contains over 300,000 unique classifications. In addition to the processing required to locate the proper SNOMED-CT code structure, the database engine necessary to locate the SNOMED-CT code that provides the base relationship will require processing resources. Besides these resources other applications, such as the image database, will require processing and memory allocation.

SNOMED-CT codes are associated with each other through a complicated algorithm and contained in a subset members table. Currently, a subset member's editor does not exist. The College of American Pathologists is working on a drag and drop editor and expects to field it within several months. The non-availability of this editor means that customizing

efforts are tedious and complicated and require a much more in-depth knowledge of the architecture than is currently available within our current resource and task level limits.

During the creation of the applications, a newer version of the SNOMED-CT database was received. No information was supplied regarding merging versions. We developed a manual system was developed to import the revised database information. Several database tables did not match the technical descriptions causing errors that required troubleshooting to ensure a successful implementation of the database content.

**PI's Evaluation:** Project Accomplishments Close to Proposal  
Project encountered no significant problems/issues

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## Second Half Project LifeCycle

- Build the next generation data parser to further refine the transformed raw data into the SOFMKC API format and revise the SOFMKC. This will allow rapid revision of the SOFMH as well as presenting the knowledge coupler data in a standardized, familiar format for ease of use.
- Validate clinical queries for solution set to data to be indicative of symptoms that are most likely to be observed by the SOF medic, rather than including complex, highly technical treatments that do not involve initial contact, life support activities, but would be accomplished at rear echelon, larger medical facilities. This will serve to reduce the solution set to a more manageable size and prevent human factor issues such as raised frustration levels and maintain the viability of the tool.
- Verify functionality of image catalog database and incorporate image catalog query responses into main database engine. An additional feature could be adding the images as another clue to the diagnosis by displaying possible image thumbnails to compare with the presented symptoms, linked via the SNOMED-CT code to the result set.
- Continue to incorporate the SNOMED-CT nomenclature to classify the information and provide "handles" to the data. Build pre-query searches with text and technical handles and have the query search the handles rather than performing either a full text (pre-limited by searching only specific database text columns) or SNOMED-CT database search. The pre-query data handles can determine which results to display depending on an algorithm that combines the number and type handles to determine and rank the result set.
- Implement editor functions and in the application of a web precursor to a stand alone hand-held application. Metrics need to be developed for evaluating students' performance while using web assistance applications in the Combat Trauma Patient Simulator against a control group who will not have access to web assistance applications. The efficiency of the tool can also be tested and further refinements to the interface accomplished.

- Create metric scenarios for test evaluation of cases by medical personnel. Use the web application to conduct additional user interface operability study to locate issues raised by the use of the application and further enhance the design of the user interface and pre-query efficiencies (a student will use an application differently than an experienced technician), search logic will be tested, and additional clues built as needed to assist in the formulation of proper symptom information to determine accuracy of the presentation.

Once a successful web application has been created and the median limits of the database solution set established, a basic template application for a Personal Digital Assistant (PDA) will be developed and tested. The database set for the PDA will include a streamlined database; overly specific, advanced treatment options will be removed.

PI's Evaluation: Project Plan is according to Proposal.

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## **Deliverable Update**

The SOFMH and its accompanying compiled information format are being used by SOF medics all over the world and they have found it to be extremely valuable. The benefit of using the completed SOFMKC will be to enhance clinical diagnosis and treatment abilities in austere environments under primitive conditions in operational settings in any location of the world and under any conditions or threat.

The SOF Medical Knowledge Coupler will be evaluated using medical patient simulators to represent clinical cases. Study participants will be divided into two groups: a control group, using the SOFMH in digital format, and an experimental group that will use the SOFMKC to determine the nature and treatment of each simulated clinical presentation. The experimental group will use the SOFMKC on a variety of platforms (stand-alone/networked, mobile device/laptop/desktop system) to simulate actual deployed conditions. Both groups will treat simulated patients based on the information gained from their reference tools. Their performance will be objectively compared for diagnostic accuracy, as well as, timeliness, effectiveness and completeness of treatment using data from the patient simulator system. After using the SOFMKC, the experimental group will complete satisfaction surveys that evaluate: ease of use, efficiency, accuracy of information, intuitive format and consistency in operation. Results will be compiled and stratified based on educational levels, healthcare positions and overall training grades to compare the appropriateness of this tool at the different echelons of care.

The benefit of this evaluation is that reliability concerns in the integrated digital system can be identified. Participants will benefit from realistic training on an advanced point-of-care medical device. Study personnel would be responsible for answering all questions related to the technology, design and use of decision support tools for accomplishing the DoD data requirements in a deployed theater of operations. Finally, the study personnel will aggregate and analyze data and develop a written report of the study findings.

The final SOFMKC product will have DOD-wide applicability since it will be able to be

used by healthcare providers at all levels in operational medicine settings.

**PI's Evaluation:** Deliverable is on schedule, per Proposal

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## Expenditures

Element of Resource (EOR)	3Q FY 01 Apr 1 - May 31	4Q FY 01 Jun 1 - Sep 30
Travel 2100	0.00	0.00
Shipping 2200	0.00	0.00
Rent & Communications 2200	0.00	0.00
Contract for Services 2500	126,712.00	126,712.00
Supplies 2600	0.00	0.00
Equipment 3100	1,576.00	5,000.00

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## Financial Narrative

The financial costs were more than anticipated in the software development and less than anticipated in hardware expenditures.

**PI's Evaluation:** Project Accomplishments Close to Proposal

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